Collaborative Technology Alliance (CTA)

Advanced Decision Architectures (ADA)

Dr. Mike Strub

ARL Collaborative Alliance Manager

Ms. Susan Archer

Consortium Manager, Micro Analysis & Design, Inc.

Advanced Decision Architectures Collaborative Technology Alliance

Consortium Partners

- Micro Analysis & Design, Inc. (Lead)
- Klein Associates
- SA Technologies
- ArtisTech, Inc.
- Ohio State University
- New Mexico State University
- University of West Florida
- Massachusetts Institute of Technology
- Carnegie Mellon University
- University of Central Florida
- University of

Objectives

To work together to develop, test, and transition new user-interface technologies and computer science innovations that will facilitate better soldier understanding of the tactical situation, more thorough evaluation of courses of action, and, ultimately, better and more timely decisions.

Technical Areas

- Cognitive Process Modeling and Measurement
- Analytical Tools for Collaborative Planning and Execution
- User-Adaptable Interfaces
- Auto Adaptive Information

Advanced Decision Architectures Collaborative Technology Alliance

PM: Micro Analysis & Design, Inc., Ms. Susan Archer
CAM: ARL, Dr. Michael Strub
Deputy CAM: ARL, Mr. Tim Hanratty

Intelligence S&T
Dr. Bev Knapp
Army G2 - ARL

Cognitive Process Modeling and Measurement

Klein Associates, Dr. Gary Klein
ARL, Dr. Laurel Allender
USMA, COL Larry Shattuck

- Conceptual Models of Cognition
- Computational Models of Cognition
- Decision-Centered Design: Principles, Methods, System Development Processes

Analytical Tools for Collaborative Planning and Execution

SA Technologies, Dr. Mica Endsley
ARL, Dr. Rick Helfman
ARL, Dr. Linda Pierce

- Research on Culture, Collaboration and Effectiveness in Teamwork
- Development of Tools and Guidelines to Support Collaboration and Decision Making in Collocated and Distributed Teams

User Adaptable Interfaces

OSU, Dr. B. Chandrasekaran
ARL, Mr. Mike Barnes
ARL, Mr. Larry Tokarcik

- Visual Representations in Decision Assistance
- Multi Modal Representations and Interactions
- Ontology and Inferencing for Natural Language and Databases

Auto-Adaptive Information Presentation

OSU, Dr. David Woods
ARL, Mr. Rob Winkler
ARL, Mr. Rich Kaste

- Cross-Adaptation in Systems
- Human Coordination with Autonomous Assets
- Auto-Adaptive Information Systems

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Work to Help Developers of Battlefield Systems

Analytical Tools for Collaborative Planning and Execution

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Work to Help Soldiers Work with Soldiers

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Work to Help Soldiers Work with Battlefield Technology

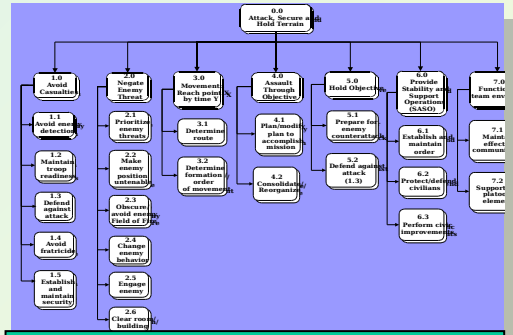
Helping Developers of Battlefield Systems

Objective: Develop tools and methods to help the soldier understand the tactical situation, more thoroughly evaluate courses of action, and, ultimately, make better and more timely decisions.

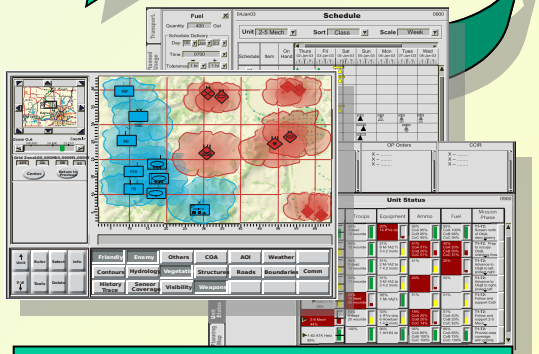
Challenges:

- Understanding the cognitive processes underlying intent centric planning
- Predicting learning and comprehension, decision making and situation awareness
- Impacting system design early in the acquisition process
- Embedding intelligent agents in battlefield systems to assist Soldiers in their real-time decision

Performance Measurement



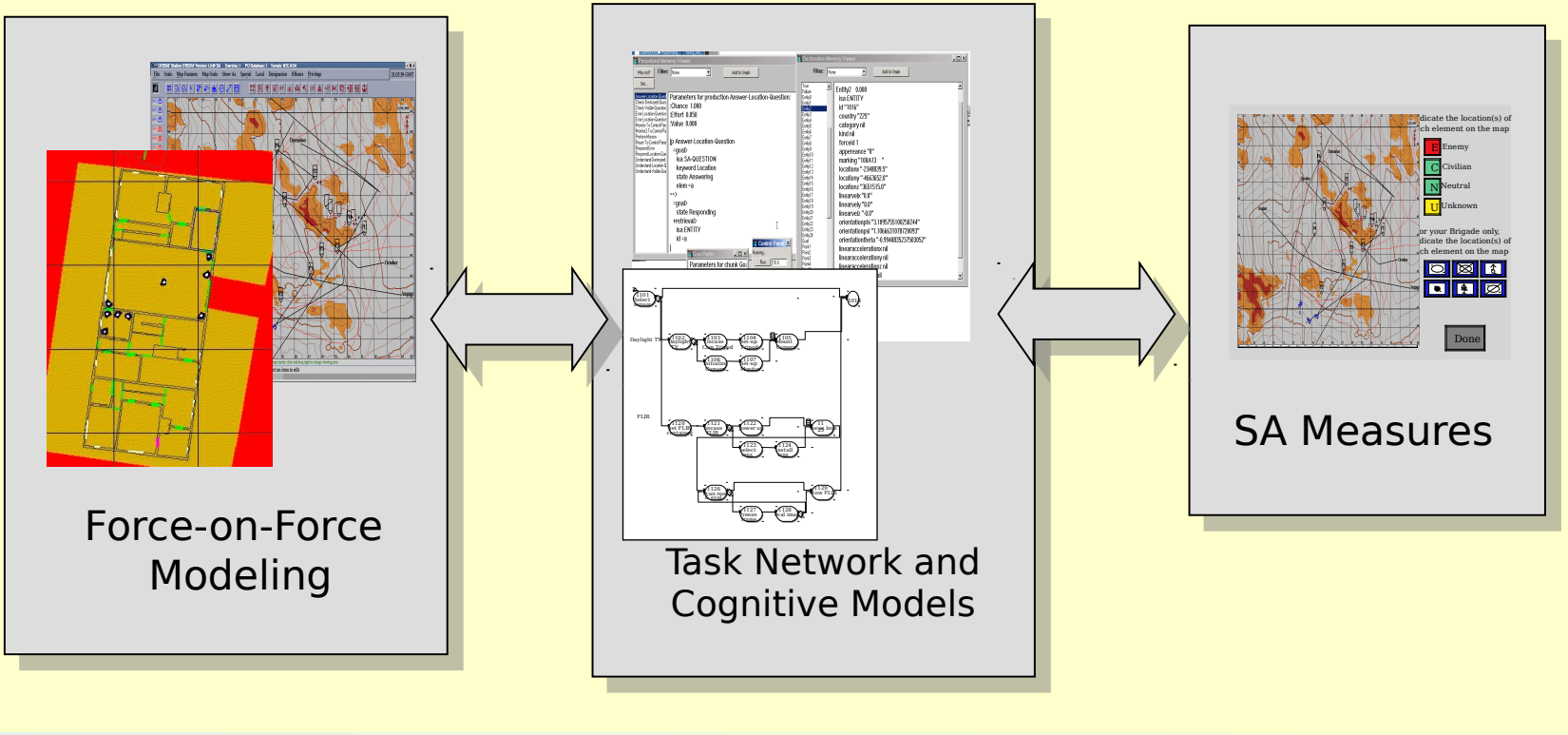
User SA-Oriented Analysis



User SA-Oriented Design

Helping Developers of Battlefield Systems Highlights

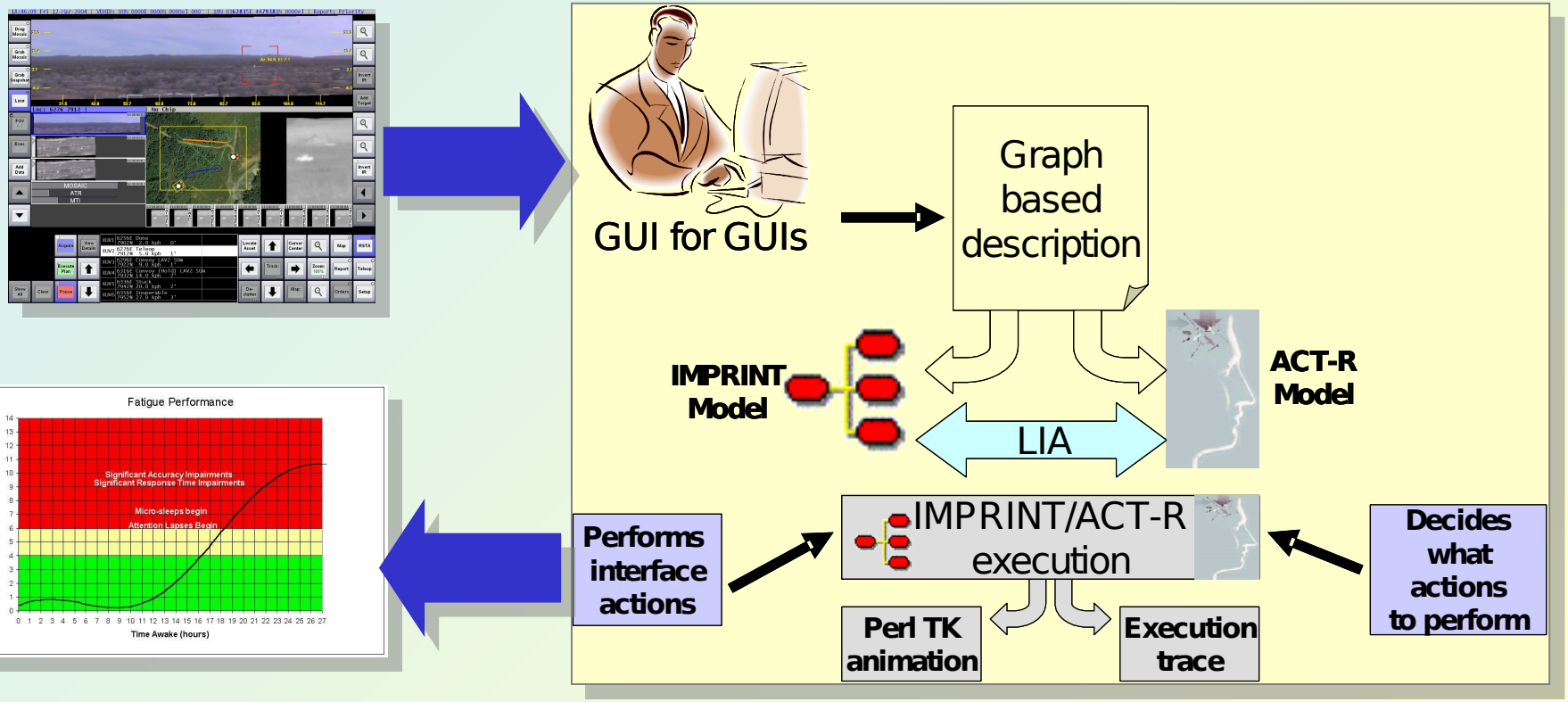
- **Accomplishments:**
  - Improved existing simulation models for training and analysis by providing an improved capability to predict human decision making



Helping Developers of Battlefield Systems Highlights

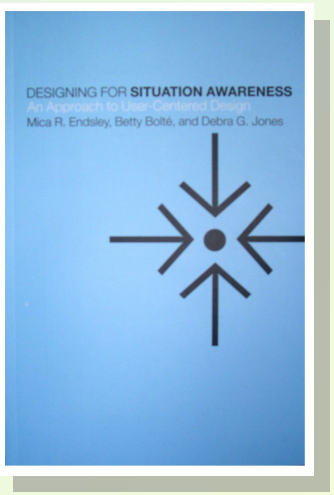
❖Accomplishments:

- ❖ Developed an integrated modeling framework for interface evaluation that makes predictions for every aspect of human performance (latency, errors, learning) without requiring the development of custom models

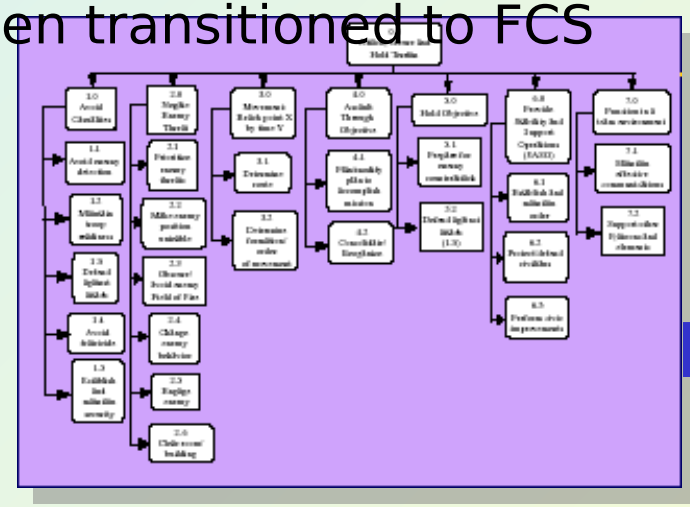


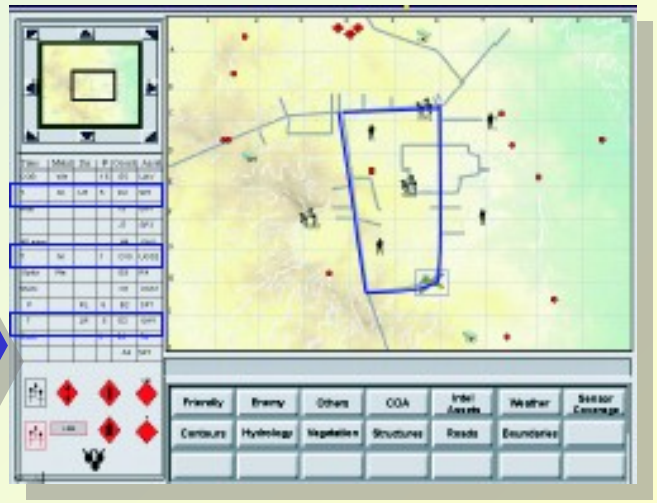
Helping Developers of Battlefield Systems Highlights

- **Accomplishments:**
  - Developed SA-Oriented Design, a principled approach for designing systems to support solider situation awareness from analysis to design principles to evaluation - *Designing for Situation Awareness* published in book form



- **Transitions:**
  - Developed Cognitive Task Analyses detailing situation awareness requirements for unit of action positions that has been transitioned to FCS





Helping Soldiers Work with Soldiers

Objective: To create tools that effectively support teams in coordinating and collaborating to achieve mission success in an environment of rapid deployment and operational tempos, diverse missions and distributed teams working across greater distances

Challenges:

- Determining how to prepare and support commanders and teams to operate in highly uncertain, dynamic environments
- Exploiting information operations to provide teams high levels of shared situation awareness and to support coordination and adaptation
- Rapidly developing and maintaining multinational coalitions
- Focusing on the critical and essential nature of collaboration in C2 problem

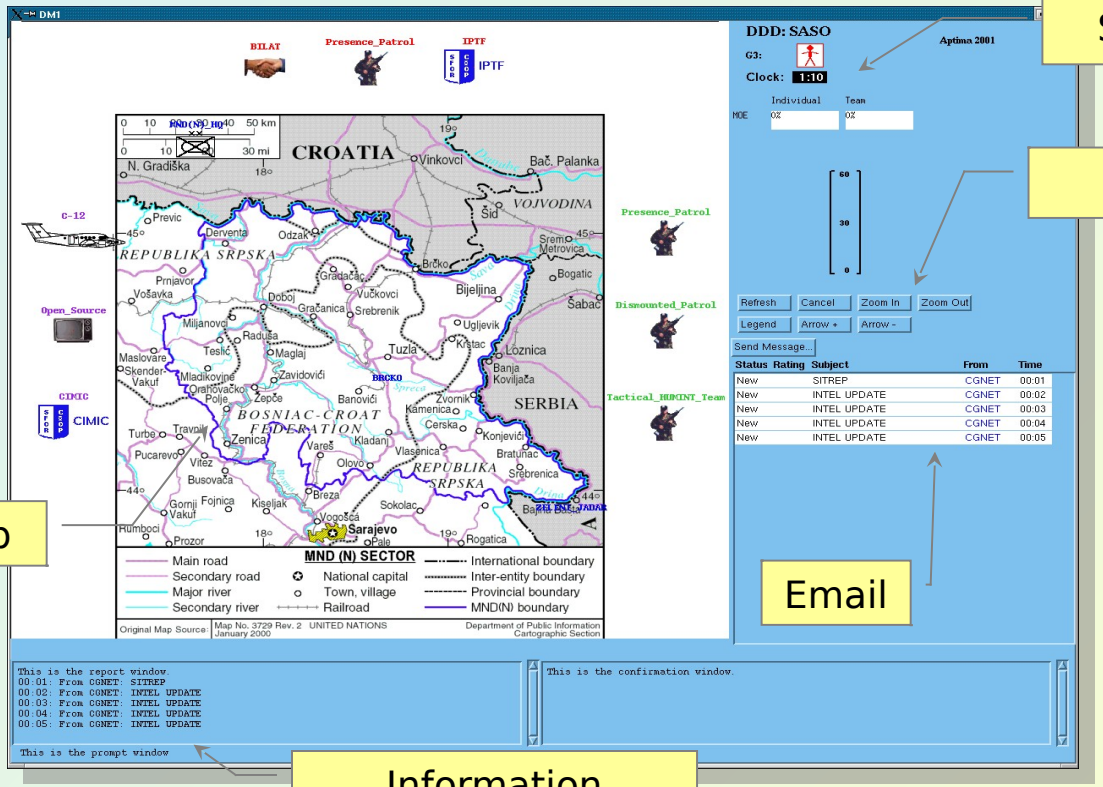
Helping Soldiers Work with Soldiers Highlights

- **Accomplishments:**
  - Developed the Collaborative SLide ANnotation Tool (CSLANT) to facilitate collaborative information exchange and knowledge sharing, while promoting team situational understanding during planning and execution of operations.
  - Developed UA display suites (Synergy) based on goal directed task analyses; validated in BCBL-L and CASCOM test beds.
  - Developed Taxonomy of Collaborative Tools to guide selection of appropriate types of tools to support different types of collaborative efforts in co-lo
  - Developed and tested objective measure of team situation awareness in Unit of Action operations

Helping Soldiers Work with Soldiers Highlights

❖Accomplishments:

- ❖ Developed laboratory to measure team cognition, culture and communication in Stability and Support Operations

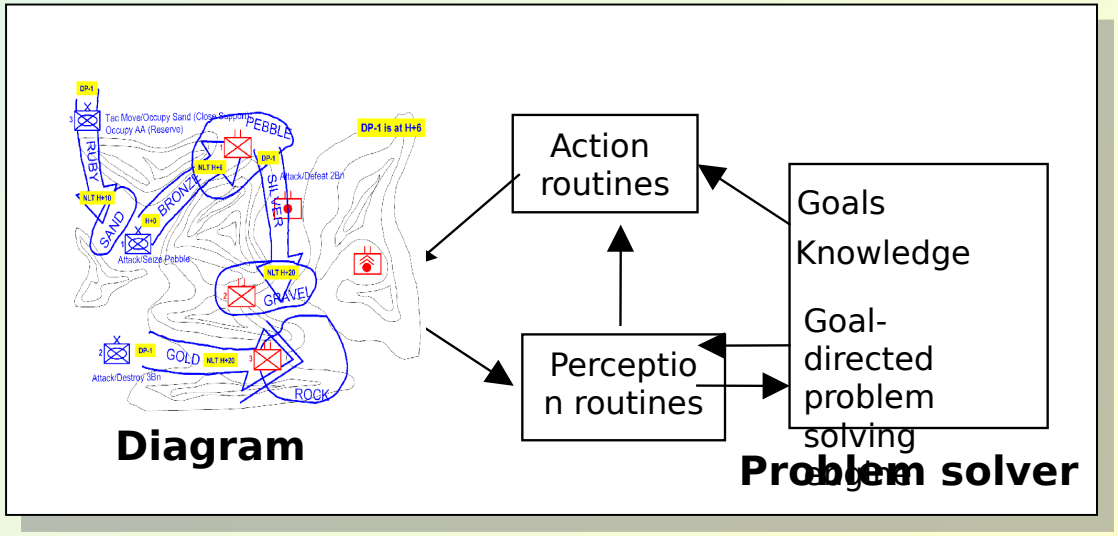


Helping Soldiers Work with Battlefield Information

Objective: Create effective user-adaptable interfaces for Army applications.

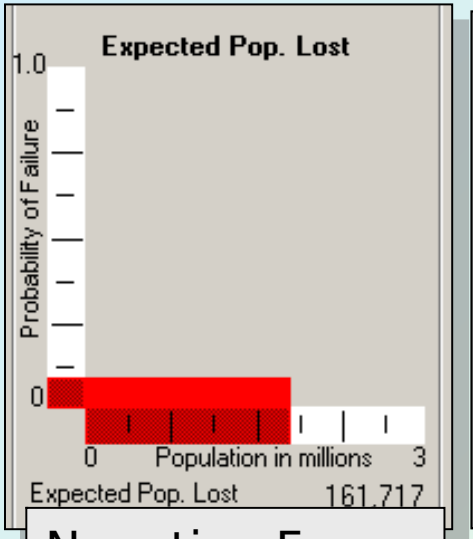
Challenges:

- Determining the conditions under which interfaces should be adapted
- Understanding the performance impact of broadening the modes used to communicate with the Soldier
- Identifying who should control the adaptation and the aspects that should be adapted
- Identifying the optimal features that allow the user to control the adaptation

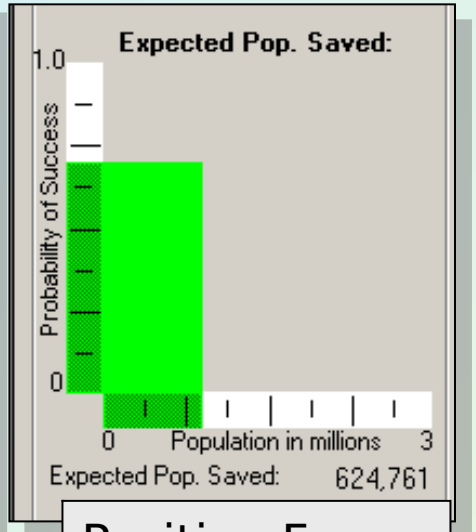


Helping Soldiers Work with Battlefield Information Highlights

❖Accomplishments:



Negative Frame



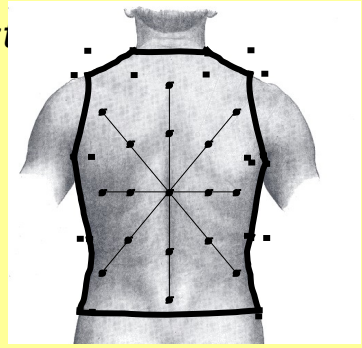
Positive Frame

- Performed research to identify how screen designs can improve visualization of risk and uncertainty. Results from a series of experiments indicate that framing information positively can result in superior SA and resource allocation decisions

- Developed haptic displays to provide tactile cues to the torso of a soldier to assist in navigation and threat location

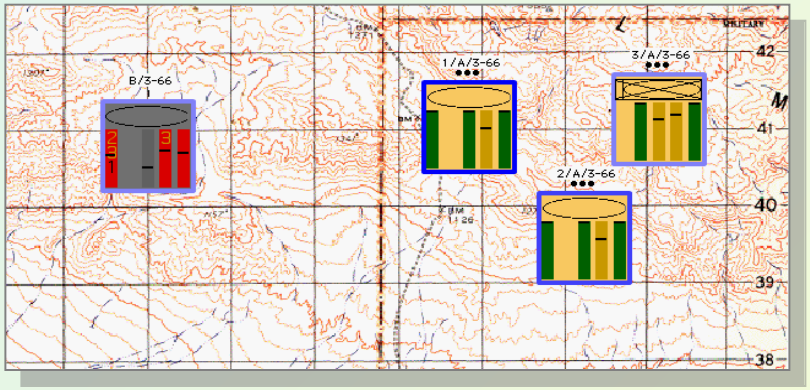
Parameters of SMA Vest

Array	28x14
Spacing	50 mm
Thickness	20 mm
Bandwidth	3 Hz
Force	1.5 N
Displacement	4 mm
Power reqd	160 J/day



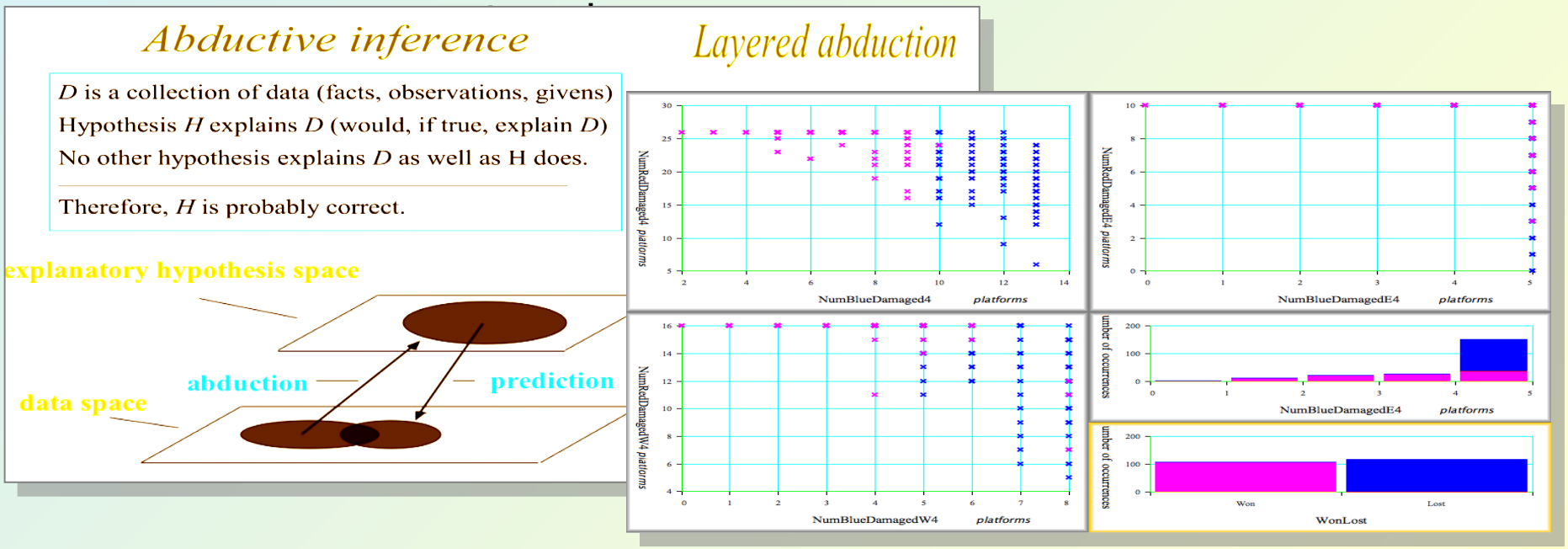
Helping Soldiers Work with Battlefield Information Highlights

- **Accomplishments:**
  - Developed software to enable commanders to quickly and efficiently compare plans with mission execution providing decision support for C2 on the move
  - Completed the first empirical study on natural tendencies of modality usage (visual, auditory, and tactile signals/messages) in the context of simulated battlefield scenarios. Results serve to inform the design of an adaptive multimodal interface to enhance synchronous co-located and distributed

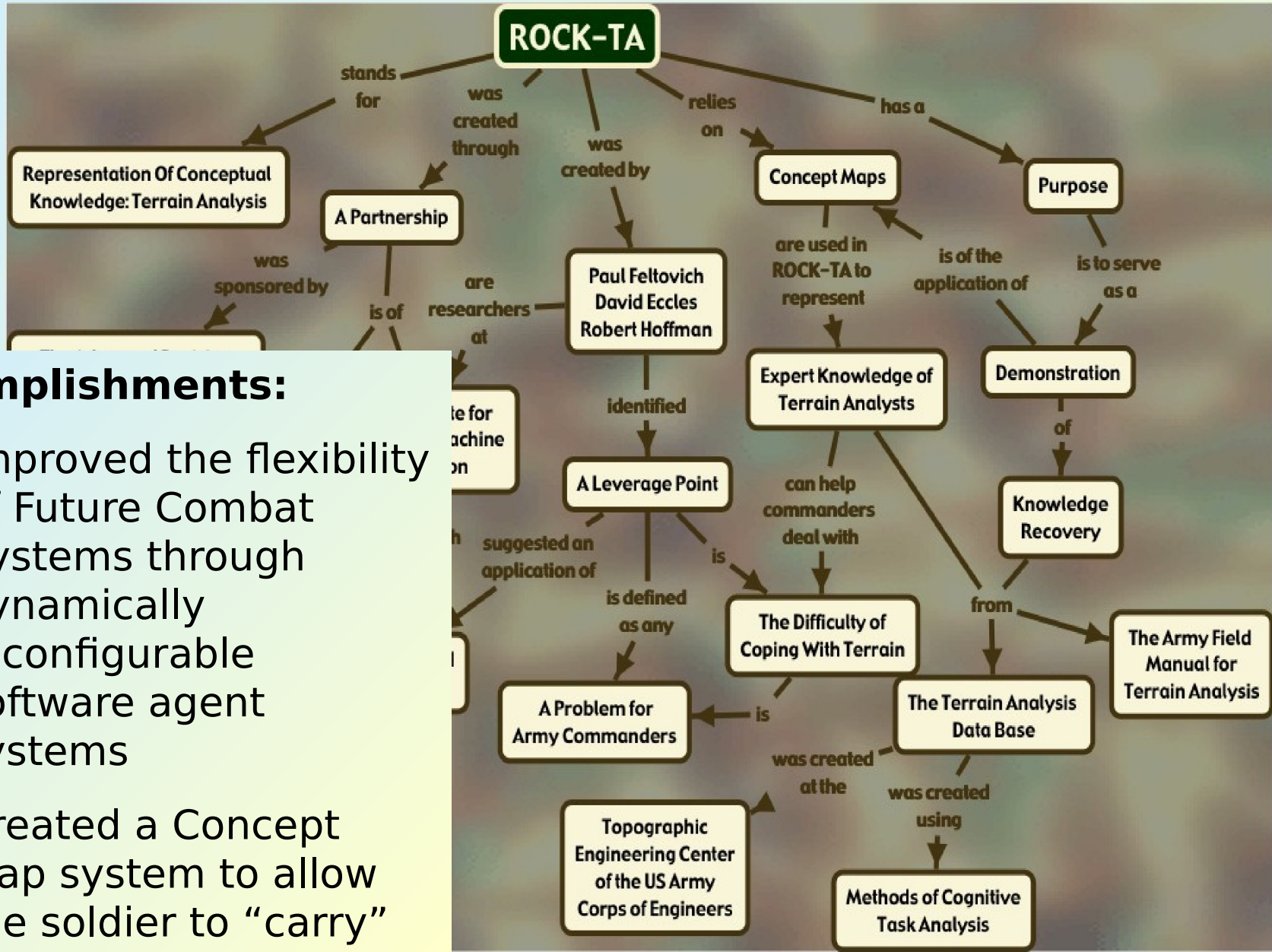


Helping Soldiers Work with Battlefield Information Highlights

- **Accomplishments:**
  - Demonstrated a Fusion Engine and Diagrammatic Reasoning system working together to solve an entity reidentification task that is central to a smarter, new generation of All Source Analysis System (ASAS)
  - Built a demonstration application to support a key example of Effects-Based Operations, planning to disrupt



Helping Soldiers Work with Battlefield Information Highlights



- **Accomplishments:**
  - Improved the flexibility of Future Combat Systems through dynamically reconfigurable software agent systems
  - Created a Concept Map system to allow the soldier to “carry”

Helping Soldiers Work with Battlefield Information Highlights

- **Transitions:**
  - Shared Displays prototype demonstrated in the 2003 Warrior's Edge (WE) exercise at Fort Benning, GA to identify enemy targets and to indicate attack approaches
  - The Digital Ink component was successfully demonstrated while on-the-move in a wireless and less than stable network at the Fort Benning Warrior's Edge exercise to identify enemy targets and to indicate attack approaches
  - Applied configural displays in a realistic Missile Defense C2 simulation environment from the GBMD Battle Lab in Colorado Springs, CO to improve operator decision making in high risk environments
  - Tools for INSCOM with advanced visualization capabilities enabled intelligence analysts to quickly identify patterns that indicate terrorist activity

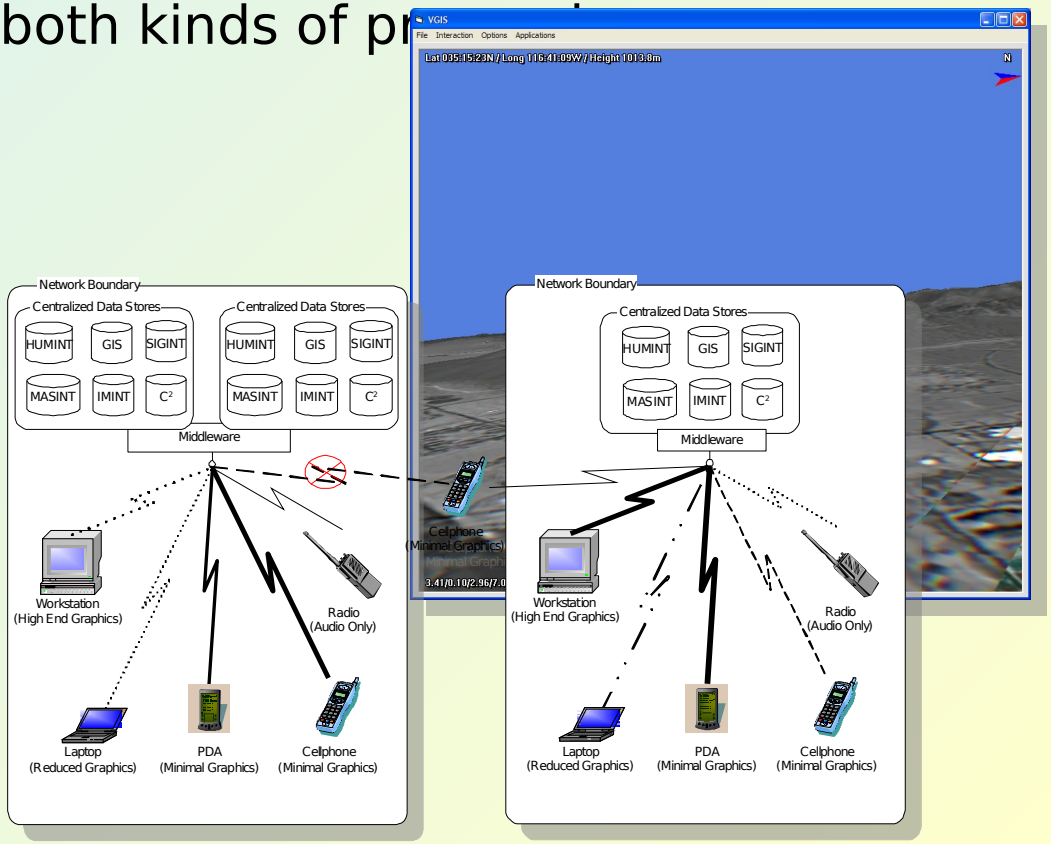
Helping Soldiers Work with Battlefield Technology

Objective: Determine how human and machine intelligence can be combined to form a coherent, joint cognitive system that fluently adapts to the changing demands of military operations

Challenges:

Mixing sophisticated human and machine capabilities while overcoming various limits on both kinds of pr

- Overcoming or balancing brittleness in machine problem solving and human biases
- Handling dynamics of problem evolution and cascading as complications arise
- Supporting adaptation of goals, assessments, and activities as circumstances

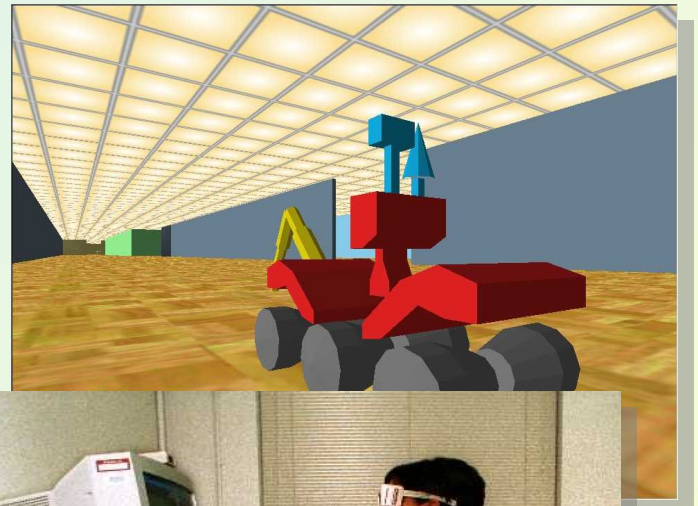


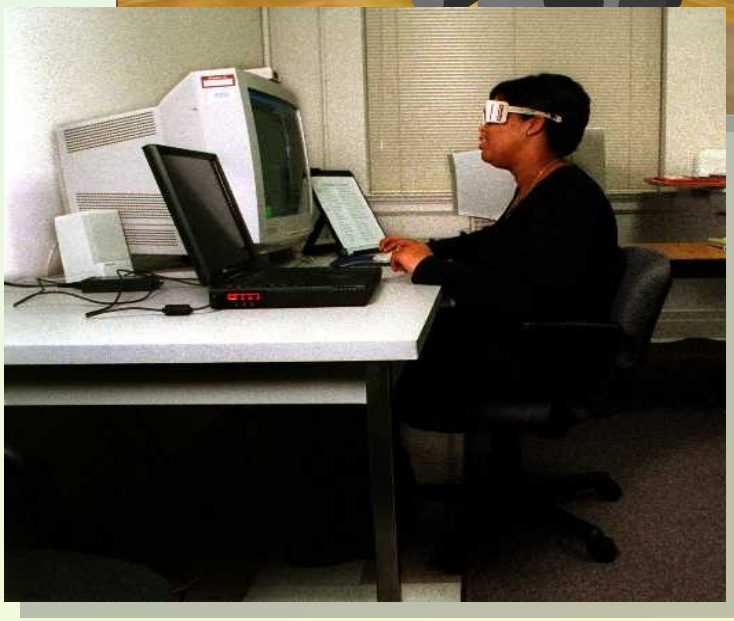
Helping Soldiers Work with Battlefield Technology Highlights

- **Accomplishments:**
  - Developing new forms of coordination between human and robotic resources
  - Working to solve the remote perception problem by developing and testing new concepts to enhance perception through a robot's sensors

Helping Soldiers Work with Battlefield Technology Highlights

- **Accomplishments:**
  - Identified display mechanisms and levels of automation for supporting shared situation awareness for soldiers working with intelligent agents
  - Developed display approaches for supporting situation awareness for controlling unmanned air and ground vehicles





The ADA CTA Directly Benefits Army Transformation

- Provides engineering methods and decision support systems to enhance ***collaboration in distributed environments and on the move***
- Develops data and techniques to ***cut the decision cycle time to get to a good decision***
- Provides data and knowledge to help the Army ***manage information and materiel resources in a complex envir***

ADA Helps Soldiers:

- **Make better and faster decisions based on displayed information**
- **Pull the “knowledge needle out of the information**